WE CLAIM:

1. An integrated multiple-rate optical time division multiplexing (OTDM) module comprising:

at least one integrated controllable optical delay switching and combining array for introducing at least one prescribed optical delay between a plurality of optical RZ signal streams to facilitate time division multiplexing of the plurality of optical RZ signal streams,

wherein the at least one integrated controllable optical delay switching and combining array is adapted to controllably introduce a selected one of a plurality of optical signal delays to at least one of the plurality of optical RZ signal streams, whereby the time division multiplexing of the plurality of optical RZ signal streams may be facilitated for a number of different data rates.

2. An integrated multiple-rate OTDM module according to claim 1 wherein the at least one integrated controllable optical delay switching and combining array comprises:

at least one optical switch; and

a plurality of optical delay elements.

3. An integrated multiple-rate OTDM module according to claim 2 wherein the at least one integrated controllable optical delay switching and combining array is arranged in a parallel configuration and further comprises:

an n:1 optical combiner,

wherein the at least one optical switch is a 1:n optical switch, and the plurality of optical delay elements comprise n optical delay elements.

4. An integrated multiple-rate OTDM module according to claim 2 wherein the at least one integrated controllable optical delay switching and combining array is arranged in a cascaded configuration and further comprises:

a 2:1 optical combiner,

wherein the at least one optical switch comprise one 1:2 optical switch and n-1 2:2 optical switches, and wherein the plurality of optical delay elements comprise 2n optical delay elements.

5. An integrated multiple-rate OTDM module according to claim 2 wherein the at least one integrated controllable optical delay switching and combining array is arranged in a parallel configuration and further comprises:

a 2:1 optical combiner,

wherein the at least one optical switch is a 1:2 optical switch, and the plurality of optical delay elements comprise two optical delay elements coupled to two outputs of the 1:2 optical switch, said two optical delay elements coupled to two inputs of the 2:1 combiner.

6. An integrated multiple-rate OTDM module according to claim 1 wherein the at least one integrated controllable optical delay switching and combining array comprise m-1 integrated controllable optical delay switching and combining arrays, wherein the at least one prescribed optical delay comprise m-1 prescribed optical delays, and wherein the plurality of optical RZ signal streams comprise m optical RZ signal streams.

7. An integrated multiple-rate OTDM module according to claim 6 wherein m is 2, and wherein the at least one

integrated controllable optical delay switching and combining array is arranged in a parallel configuration and comprises:

a 1:n optical switch;

n optical delay elements; and

an n:1 optical combiner,

wherein the plurality of optical delays comprise a set of n optical delays.

8. An integrated multiple-rate OTDM module according to claim 6 wherein m is 2, and wherein the at least one integrated controllable optical delay switching and combining array is arranged in a cascaded configuration and comprises:

a 1:2 optical switch;

n-1 2:2 optical switches;

2n optical delay elements; and

a 2:1 optical combiner.

9. An integrated multiple-rate OTDM module according to claim 6 wherein m is 2, and wherein the at least one integrated controllable optical delay switching and combining array comprises:

a 1:2 optical switch;

two optical delay elements; and

a 2:1 optical combiner.

10. An integrated multiple-rate OTDM module according to claim 6 wherein the m-1 prescribed optical delays comprise the set of prescribed optical delays Tj/m where $j \in \{1,...,m-1\}$ and T is a period of the plurality of optical RZ signal streams.

11. An integrated multiple-rate OTDM module according to claim 1 wherein at least one electrode is deposited over a portion of a waveguide having at least one of the plurality of optical RZ signal streams travelling therein, wherein a voltage applied to the at least one electrode is used for fine tuning an optical time delay introduced to the at least one of the plurality of optical RZ signal streams travelling in the portion of a waveguide.

12. An integrated multiple-rate OTDM module according to claim 1 further comprising a waveguide power tap for each of the plurality of optical RZ data streams.

13. An integrated optical time division multiplexing (OTDM) subsystem comprising:

an optical pulse source (OPS) chip;

an integrated multiple-rate optical time division multiplexing (OTDM) chip comprising at least one integrated controllable optical delay switching and combining array for introducing at least one prescribed optical delay between a plurality of optical RZ signal streams to facilitate time division multiplexing of the plurality of optical RZ signal streams, wherein the at least one integrated controllable optical delay switching and combining array is adapted to controllably introduce a selected one of a plurality of optical signal delays to at least one of the plurality of optical RZ signal streams, whereby the time division

multiplexing of the plurality of optical RZ signal streams may be facilitated for a number of different data rates; and

optical connections interconnecting the OPS chip and the multiple-rate OTDM chip,

wherein the OPS chip and the multiple-rate OTDM chip are integrated in a single substrate using hybrid packaging technology.

14. An integrated optical time division multiplexing (OTDM) subsystem according to claim 13 wherein the OPS chip comprises:

a photodiode;

a laser source;

an electro-absorption modulator (EAM); and

a semiconductor optical amplifier (SOA),

wherein the photodiode monitors the optical power of the laser source, and the laser source produces an optical signal for gating by the EAM producing an optical pulse signal, said optical pulse signal amplified by the SOA to produce an amplified optical pulse signal, said amplified optical pulse signal provided to the multiple-rate OTDM chip for use in multiplexing a plurality of data signals.

15. An integrated optical time division multiplexing (OTDM) subsystem according to claim 14, wherein the EAM and the laser source are integrated in the same semiconductor chip.

16. An integrated optical time division multiplexing (OTDM) subsystem according to claim 14, wherein the EAM and the SOA are integrated in the same semiconductor chip.

17. An integrated optical time division multiplexing (OTDM) subsystem according to claim 14, wherein the EAM, the SOA, and the laser source are integrated in the same semiconductor chip.

18. A multiple-rate optical time division multiplexing (OTDM) module comprising:

at least one controllable optical delay switching and combining array for introducing at least one prescribed optical delay between a plurality of optical RZ signal streams to facilitate time division multiplexing of the plurality of optical RZ signal streams,

wherein the at least one controllable optical delay switching and combining array is adapted to controllably introduce a selected one of a plurality of optical signal delays to at least one of the plurality of optical RZ signal streams, whereby the time division multiplexing of the plurality of optical RZ signal streams may be facilitated for a number of different data rates.